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TREE GRADES FOR LOBLOLLY AND SHORTLEAF PINE

by

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TREE GRADES FOR LOBLOLLY AND SHORTLEAF PINE[1/]

Most of us can tell a poor tree from one of good quality. Yet only a few can translate this into actual value without chance of considerable error. Those who can make reasonable close estimates of value usually have years of woods and mill experience behind them. Their method is no trade secret but only a knack acquired from long practice. Unfortunately this cannot be passed on readily to others. Therefore, a great need exists for a simple method of measuring quality in standing trees--one that can be learned after a few hours training.

An easy method of grading loblolly and shortleaf pine trees is possible. This may be concluded from a study made on the Santee Experimental Forest in 1947. In this Berkeley County, South Carolina, area a grade yield study of 259 loblolly and shortleaf pine trees resulted in a system of only four relatively simple tree grades. For want of a better name, it is called the Santee Tree Grading System. Actually it is based on log grades designed for use at Crossett, Arkansas.2/ Yet these log grades were found readily adaptable for use with the loblolly and shortleaf pine of the Carolina low country (fig. 1). On the whole they are quite simple in application and give fairly uniform results with significant differences in lumber grade recovery between grades. Thus

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2/ These log grades are described in U. S. Dept. Agr. Tech. Bul. 861, Financial Aspects of Selective Cutting in the Management of Second-Growth Pine-Hardwood Forests West of the Mississippi River.

by classifying the butt and, in certain cases, the second 16-foot log by the Crossett system, trees may be graded by the Santee method as follows:

Santee Tree Grades

1-2 - - - Butt log a grade #1 and second log grade #2 or better

1-3 - - - Butt log a grade #1 and second log grade #3

2 - - - Butt log a grade #2

3 - - - Butt log a grade #3

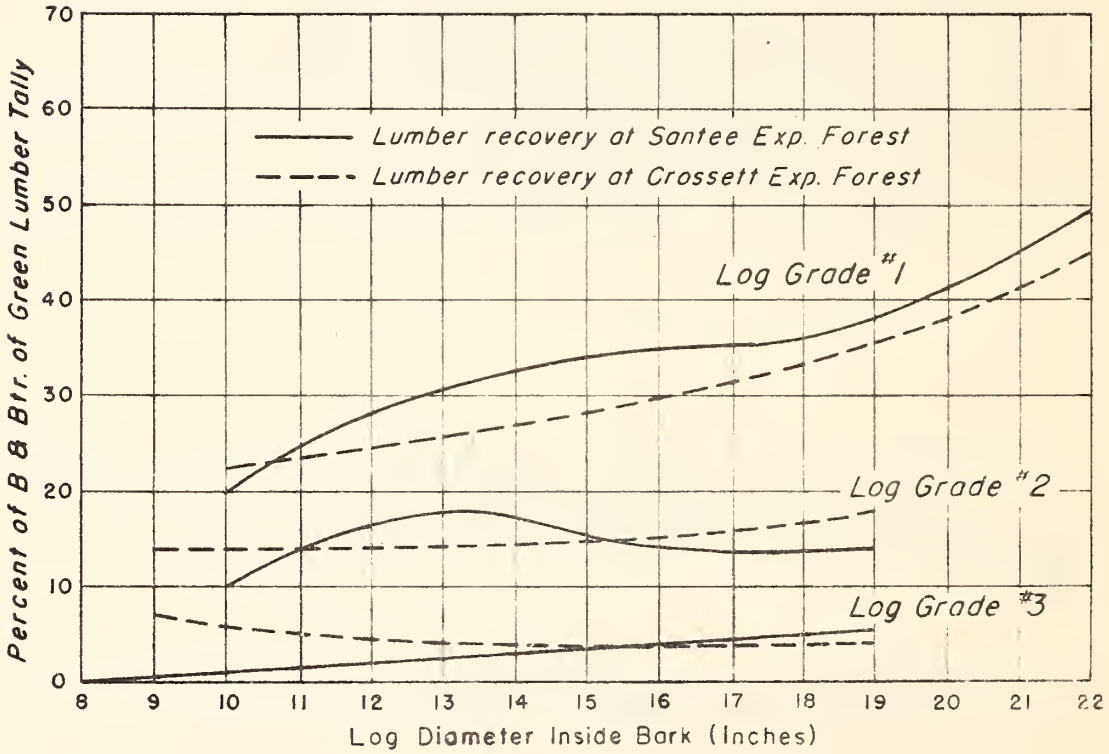

Figure 1.--Comparison of percent of B and Better recovered at Crossett and Santee Experimental Forests.

The Crossett Log Grades are based on the number and size of knots as found on three sides (faces) by log size groups. Each log is considered as having four faces but only three of them enter into the grading, for the face on the ground or on the far side of a tree is not seen by the grader. In brief, only three-fourths of the log's circumference is graded.

When used on the Santee, certain minor changes were made in the Crossett grades to preclude certain misinterpretations. Accordingly, the log grades are defined as follows:

Grade #1

Logs 10.0 inches and larger i.b. at the small end absolutely surface clear (not considering adventitious knots and branches).

Logs 16.0 inches or larger with not more than three 2- to 4-inch knots and any number of small knots.

Grade #2

Logs 8.0 inches to but not including 10.0 inches, surface clear.

Logs 8.0 inches to but not including 14.0 inches with any small knots.

Logs 14.0 inches to but not including 16.0 inches with not more than six 2- to 4-inch knots and any number of small knots.

Logs 16.0 inches and larger containing four to not more than six 2- to 4-inch knots and any number of small knots.

Grade #3

Logs 8.0 inches to but not including 14.0 inches with any 2- to 4-inch knots.

Logs 14.0 inches and larger with more than six 2- to 4-inch knots.

Any log with one or more knots 5 inches and larger.

Small knots are those less than 2.0 inches in diameter.

Some exercise of personal judgment is necessary in applying these rules. A higher grade is usually given if a log has more knots than the grade allows but which are bunched at one end or on one face. Logs well over the diameter limit for the grade which have one or two more knots than the grade allows but are superior in other respects are usually upgraded; for instance, a 15-inch log with seven 2- to 4-inch knots, if they are at the lower end of the size range and the log has no other knots, will be grade 2 instead of grade 3. Another good example is a rather large log, say 20 inches, with four 2- to 4-inch knots instead of three but otherwise of high quality. It will be called a grade 1 instead of grade 2.

Figure 2 illustrates the general classes of surface defects indicating knots. Identifying and estimating size of overgrown knots is probably the hardest part of grading. Most helpful is the fact that knot size classes are few and rather broad (under 2 inches, 2 to 4 inches, 5 inches and larger). In general, knot size may be determined as follows:

1. When the limb is still attached, the diameter immediately above the swell is taken as knot diameter.

2. After the knot starts to grow over and until the knot outline starts to break up, the diameter of the outline is taken as that of the knot.

3. After the knot outline starts to break up, the diameter of the knot is taken as the approximate sum of the diameters of several parts of the outline.

4. Diameters of knots are always taken at right angles to the stem.

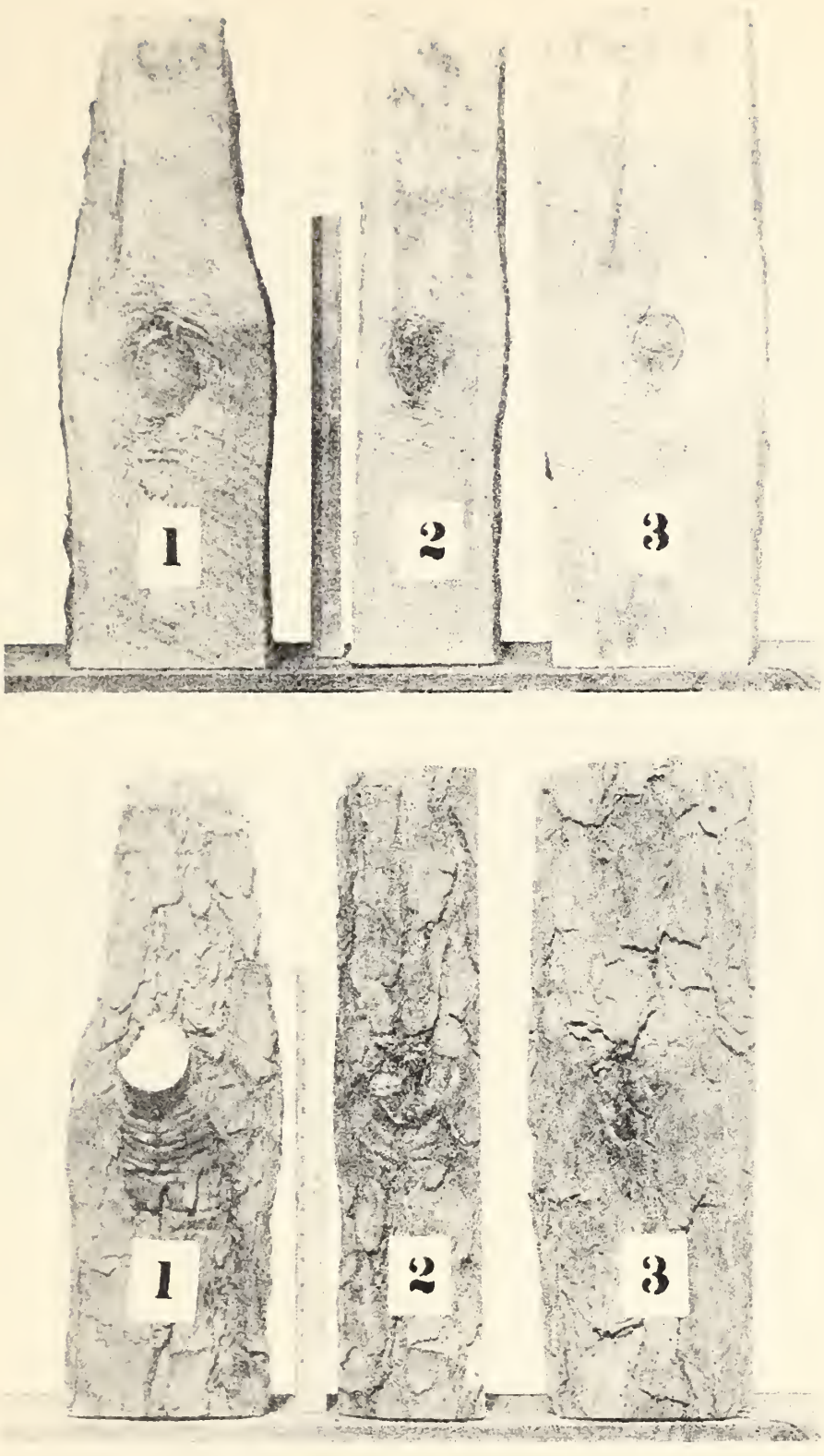

Figure 2.--Outside and inside of slabs showing principal types of knot indicators, (1) branch, (2) open knot, (3) overgrown knot. All are in the 2- to 4-inch size class.

Furthermore, it is well to know that knots are easier to see on the sunny side of the tree. Consequently the grader usually faces that side of the tree.

The study leading up to the tree grading system was carried out in a stand of forest grown loblolly and shortleaf pine. Average age was estimated as 49 years and site index at 82 feet. The stand of pine averaged 11 M board feet (Int. $\frac{1}{4}$-inch rule) per acre. The trees removed, and from which the study sample was drawn, consisted mainly of hold-overs from a previous cutting, poor risks, and the most poorly formed trees. Generally the trees were of a type removed in early cuts on managed forest land.

The sample was a random selection of 205 loblolly and 54 shortleaf pine trees. These trees yielded a total of 862 logs which in addition to being diagrammed were also graded in the field by the Crossett method. By means of the log diagrams the field grading was checked in the office as part of the computations. Each log as it was graded was also scaled by the Scribner Decimal C and the International $\frac{1}{4}$-inch rules.

The study logs were sawed by a mill at the Cooper River Lumber Company, a concentration yard near Moncks Corner, S. C. The mill was of a portable type with a 125-horsepower Diesel unit. The head saw was a 52-inch circular. The carriage had a belt feed with manual set works operated by one man riding the carriage. Logs were rolled onto the carriage and turned with cant hooks by a two-man crew. Edging was by means of a two-saw edger. Mill arrangement was conventional. The sawing was on contract, and daily production consisting of 4/4 to 5/4 boards ranged from 15 to 20 M board feet.

The lumber from each log was graded at the mill, under Southern Pine Association grading rules, by a company grader recognized by the Southern Pine Inspection Bureau. In addition to grade, length was also marked on each board by the grader. The lumber was tallied by individual logs.

In figure 3 the percentage yield of lumber grades as obtained in the study is shown for each of the four tree grades. These are cumulative graphs which show yield of various lumber grades in their order of quality and value. It is apparent from these graphs that the tree grades show adequate stratification and significant differences in lumber grade recovery. As may be expected, the better the tree grade the higher the yield of quality lumber. Tree grade 1-2 has a yield of 34 to 42 percent C & Better lumber, grade 1-3 produces 19 to 32 percent, grade 2 gives 17 percent, and grade 3 only 7 percent in these finish grades of lumber. Lumber grade recovery by tree size and tree grade is also presented in table 1.

An interesting comparison between tree grades is in terms of cash value. For this purpose local f.o.b. mill prices are used. Trees in each grade are assumed to be 20 inches d.b.h., contain 3 logs, and are form class 80. According to our study these trees will yield 360 board feet in terms of green lumber tally. The value by tree grades is as follows:

Lumber Grade	Tree Grade			
	1-2	1-3	2	3
B&Better at $170 per M	$14.08	$ 9.86	$ 4.90	$ 2.45
C at $160 per M	8.64	8.64	5.18	1.73
No. 1 Com. at $85 per M	7.34	6.72	5.81	3.98
No. 2 Com. at $80 per M	9.79	12.64	17.86	22.18
No. 3 Com. at $50 per M	.72	.55	.36	.54
Total value	$40.57	$38.41	$34.11	$30.88

It should be stated here that very little difference in value is added by recognition of board widths as compared to an evaluation based on random widths. In the 20-inch d.b.h. class, for example, this difference was only about 3 percent. There were no significant differences in the 12-, 14-, and 16-inch classes.

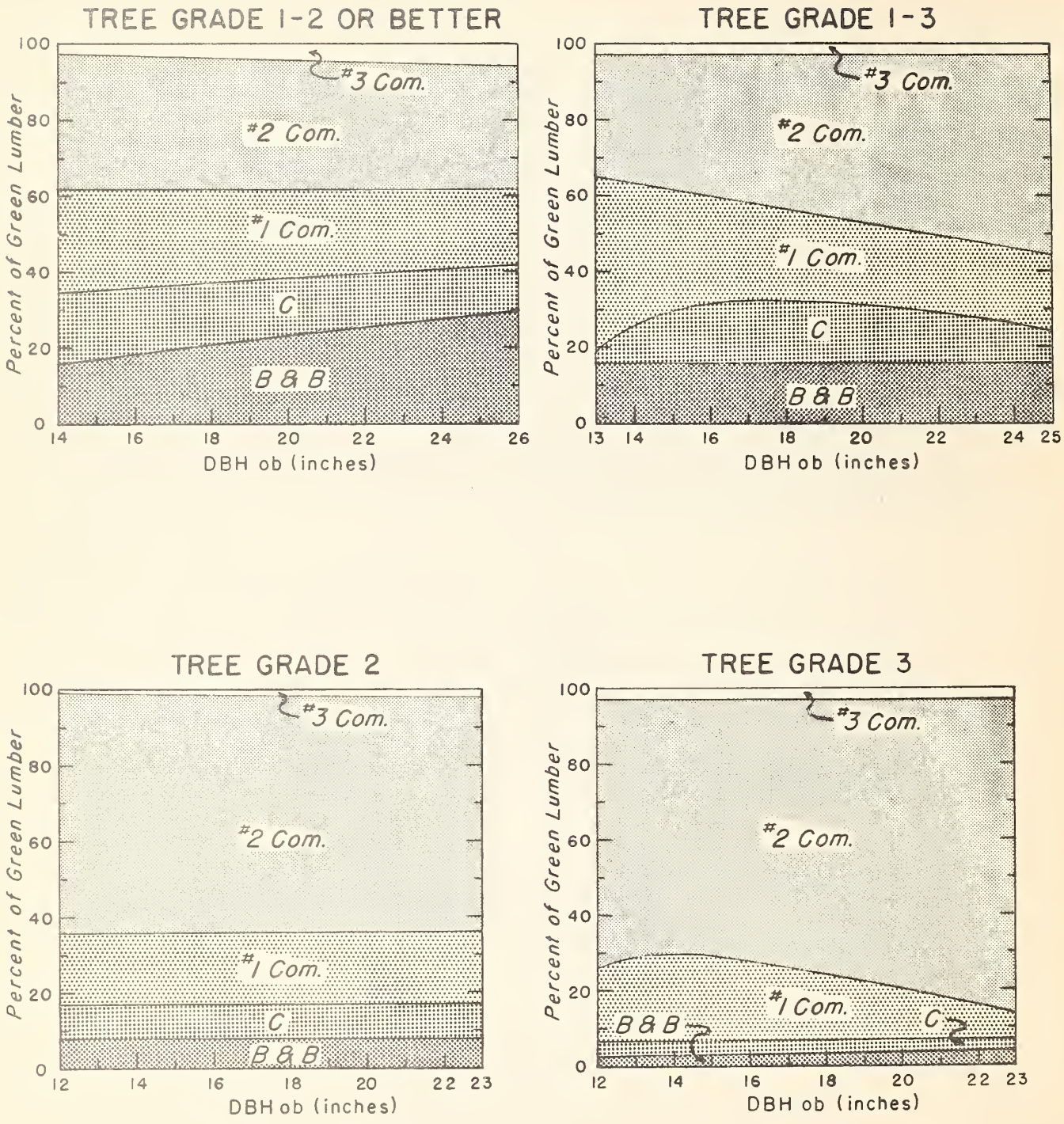

Figure 3.--Lumber grade recovery by tree size and tree grades.

Table 1.--Lumber grade recovery by tree size and tree grade

DBH	Tree Grade 1-2					Tree Grade 1-3				
	B&B	C	#1 Com.	#2 Com.	#3 Com.	B&B	C	#1 Com.	#2 Com.	#3 Com.
	Percent of Green Lumber					Percent of Green Lumber				
12										
13						16	2	47	32	3
14	16	18	28	35	3	16	10	37	34	3
15	17	18	27	35	3	16	14	31	36	3
16	18	18	26	35	3	16	15	29	37	3
17	20	17	25	34	4	16	16	26	39	3
18	21	16	25	34	4	16	16	24	41	3
19	22	16	24	34	4	16	16	23	42	3
20	23	15	24	34	4	16	15	22	44	3
21	24	15	23	33	5	16	14	21	46	3
22	25	14	23	33	5	16	13	20	48	3
23	27	13	22	33	5	16	12	20	49	3
24	28	13	21	32	6	16	10	20	51	3
25	29	12	21	32	6	16	8	20	53	3
26	30	12	20	32	6					

DBH	Tree Grade 2					Tree Grade 3				
	B&B	C	#1 Com.	#2 Com.	#3 Com.	B&B	C	#1 Com.	#2 Com.	#3 Com.
	Percent of Green Lumber					Percent of Green Lumber				
12	8	9	19	63	1	3	4	19	71	3
13	8	9	19	63	1	3	4	22	68	3
14	8	9	19	63	1	3	4	23	67	3
15	8	9	19	63	1	3	4	22	68	3
16	8	9	19	63	1	3	4	21	69	3
17	8	9	19	63	1	3	4	19	71	3
18	8	9	19	62	2	4	3	17	73	3
19	8	9	19	62	2	4	3	15	75	3
20	8	9	19	62	2	4	3	13	77	3
21	8	9	19	62	2	4	3	11	79	3
22	8	9	19	62	2	4	3	9	81	3
23	8	9	19	62	2	4	3	7	83	3
24	8	9	19	62	2	4	3	6	84	3

Unfortunately, grade recovery in terms of boards only was possible. For the present at least this means that the results are directly applicable to only those timber stands and localities where boards are the chief product.

To those interested in using the tree grading system and the related grade yield in timber appraisal work, information regarding defect and overrun will also be useful. Figure 4 shows the amount of scaled defect, not including woods cull per tree diameter class as measured in the study.

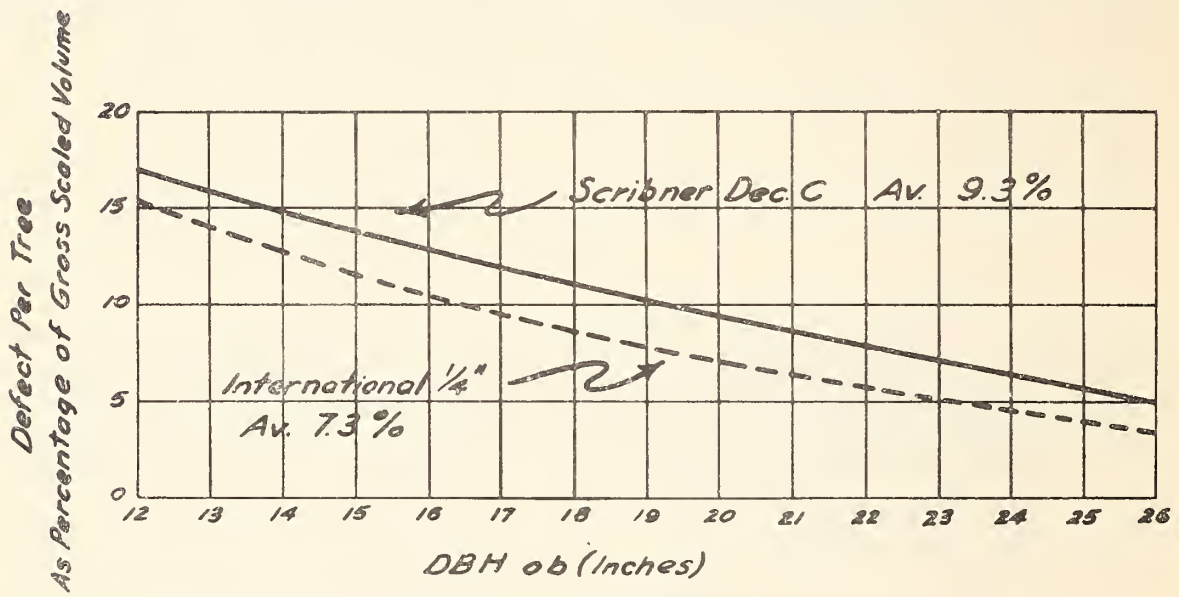

Figure 4.--Defect by tree diameter classes based on scaled tree volumes.

Figure 5 represents the overrun and underrun for the Scribner and International $\frac{1}{4}$-inch rules respectively. It is well to mention that lumber tally is based on the grader's estimate of how the boards would be manufactured by grade. For example, many boards were cut back 2 or more feet to improve the grade.

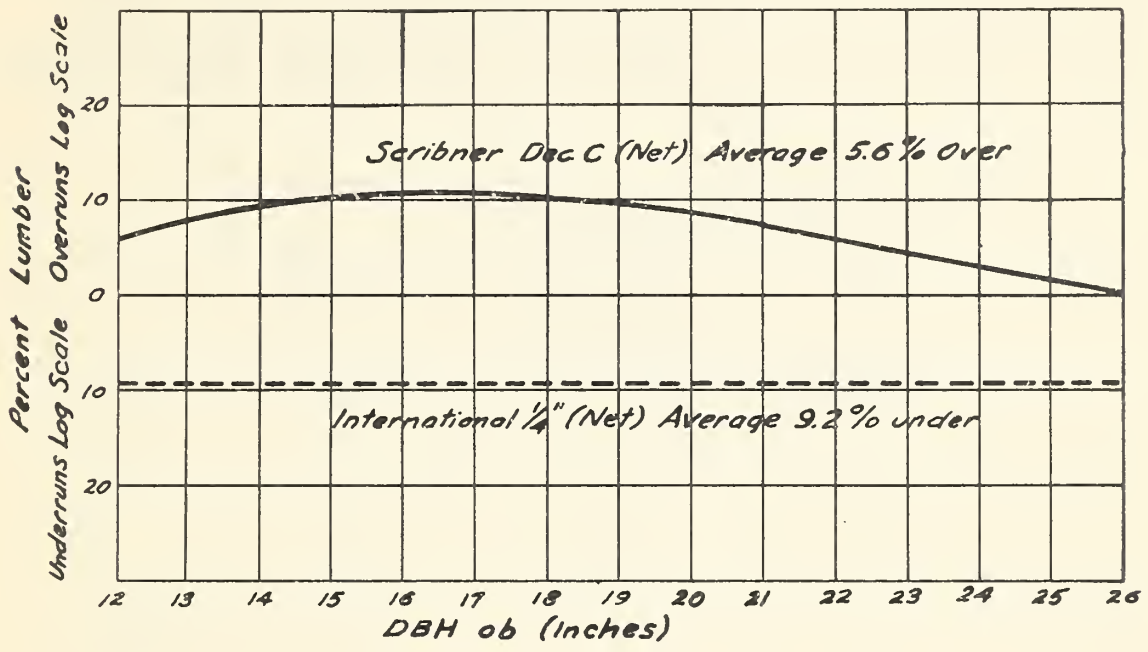

Figure 5.--Overrun or underrun in terms of log rule by tree diameter class.

Procedure for computing estimated lumber values for standing timber requires only the simplest arithmetic. As an example, assume it is desired to predict the lumber value of a tree of grade 1-3, whose diameter is 20 inches and merchantable height is 3 logs. The volume table estimates its gross volume as 427 board feet by the International $\frac{1}{4}$-inch rule. Since lumber grade and value are based

on green-chain tally, it is first necessary to convert the gross volume to those specifications. This is done by correcting the gross volume for defect and overrun. From figure 4, defect is estimated at 7 percent, and the deduction in board feet is thereby computed to be 30 board feet, leaving a net sound volume of 397 board feet. From figure 5, overrun is estimated to be -9.2 percent. A negative overrun means an underrun--in this case 37 board feet. This further adjustment leaves 360 board feet as the estimated green lumber tally. Lumber values are then readily available by multiplying this quantity by the percent grade yield from table 1 and the mill value per M bd.ft. These computations would appear thus:

Grade	Estimated yield		Mill price per M bd.ft.	Total value
	From table 1	Percent yield times green lumber tally (360 bd.ft.)		
	Percent	Board feet	Dollars	Dollars
B & B	16	58	170	9.86
C	15	54	160	8.64
1 Com.	22	79	85	6.72
2 Com.	44	158	80	12.64
3 Com.	3	11	50	.55
Total	100	360	-	38.41

The value of a tree of the specifications given is then $38.41 for the tree, or $38.41 $\left(\frac{1000}{360}\right)$ = $106.69 per thousand board feet in such trees.

This study was carried out by the staff of the Santee Experimental Forest for the main purpose of determining the grades of lumber that could be cut out of the Forest's timber. A major part of the research program on the Santee is directed toward determining the best methods of managing loblolly pine on a commercial scale from the standpoint of financial return as well as its silviculture. In order to properly evaluate

the yield resulting from each method of management, volume determination alone will not suffice. We must also measure quality. A grade yield study at the time of each cut is not practical. Consequently a method of log or tree grading with associated grade yields must be used. A tree grading system is favored as it enables a ready evaluation of the timber left as well as that cut into logs.

The question will arise as to the usefulness of the Santee Grading System in other localities. This cannot be answered until it is tried elsewhere within the range of loblolly, shortleaf, and on other southern pine species. The sample trees averaged about 3 logs per tree. It is recognized that there will be some departure from the indicated lumber grade yields for timber taller or shorter or with greater or lesser utilization. The extent of departure has not been determined. The system seems quite adequate for determining the grades that would be cut out of shortleaf and loblolly pine timber located on the Experimental Forest. The forest types and conditions found there are quite representative of the lower coastal plain of South Carolina. However, it is quite likely that the system can be improved and there may be better systems. In this connection a working committee of members from the Southern and Southeastern Forest Experiment Station of Region 8, U. S. Forest Service, has been formed with an objective of developing adequate log and tree grades for southern pine. On the Santee Forest we will continue to use the system proposed herein, at least until a better method is devised. It is planned to give it further tests on other tracts of timber within the Experimental Forest and to try it out on longleaf pine. These tests will be associated with grade yield determinations.